Cost of Living and Productivity

ECON8069 - Lecture 8

Australian National University

Cost of Living and Productivity

- Quiz this week (Friday 2pm to 8pm as usual)
- Cost of Living
- Production Functions

Textbook: Section 19.4, Chapter 20.

Cost of Living

- GDP was good (though not perfect) for telling us how production occurred in the economy
- However, we also need a way to measure changes in prices, or the cost of living, over time
- We will use two measures, the GDP Deflater, and the Consumer Price Index (CPI)

GDP Deflator

- GDP Deflator is used less than Consumer Price Index (CPI) to measure changes in the cost of living
- But, it follows very easily and naturally from our previous work on the GDP

GDP Deflator

The GDP Deflator for a given year is the ratio between Nominal GDP and Real GDP, expressed as a percentage.

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- GDP Deflator depends both on the target year, and also the choice of 'base year'
- This is because Real GDP depends on the choice of base year

GDP Deflator - Simple Calculation

Year	Value of Butter	Value of Guns	GDP (nominal)
2021	\$2 x 150 = \$300	\$1 x 400 = \$400	\$700
2022	\$3 x 200 = \$600	\$1.5 x 600 = \$900	\$1500
2023	\$4 x 175 = \$700	\$2.5 x 500 = \$1250	\$1950

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	Value of Butter (2021 prices)	Value of Guns (2021 prices)	GDP (real)
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We can now calculate GDP deflators

GDP Deflator - Calculation

Using 2021 prices for the base year:

Year	GDP (nom)	GDP (real)	GDP deflator
2021	700	700	100
2022	1500	1000	150
2023	1950	850	229

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Observation: GDP deflator is a weighted average of price increases.

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- *Homework exercise*: Compute the Percentage Change in GDP Deflator taking 2023 as the base year for prices.

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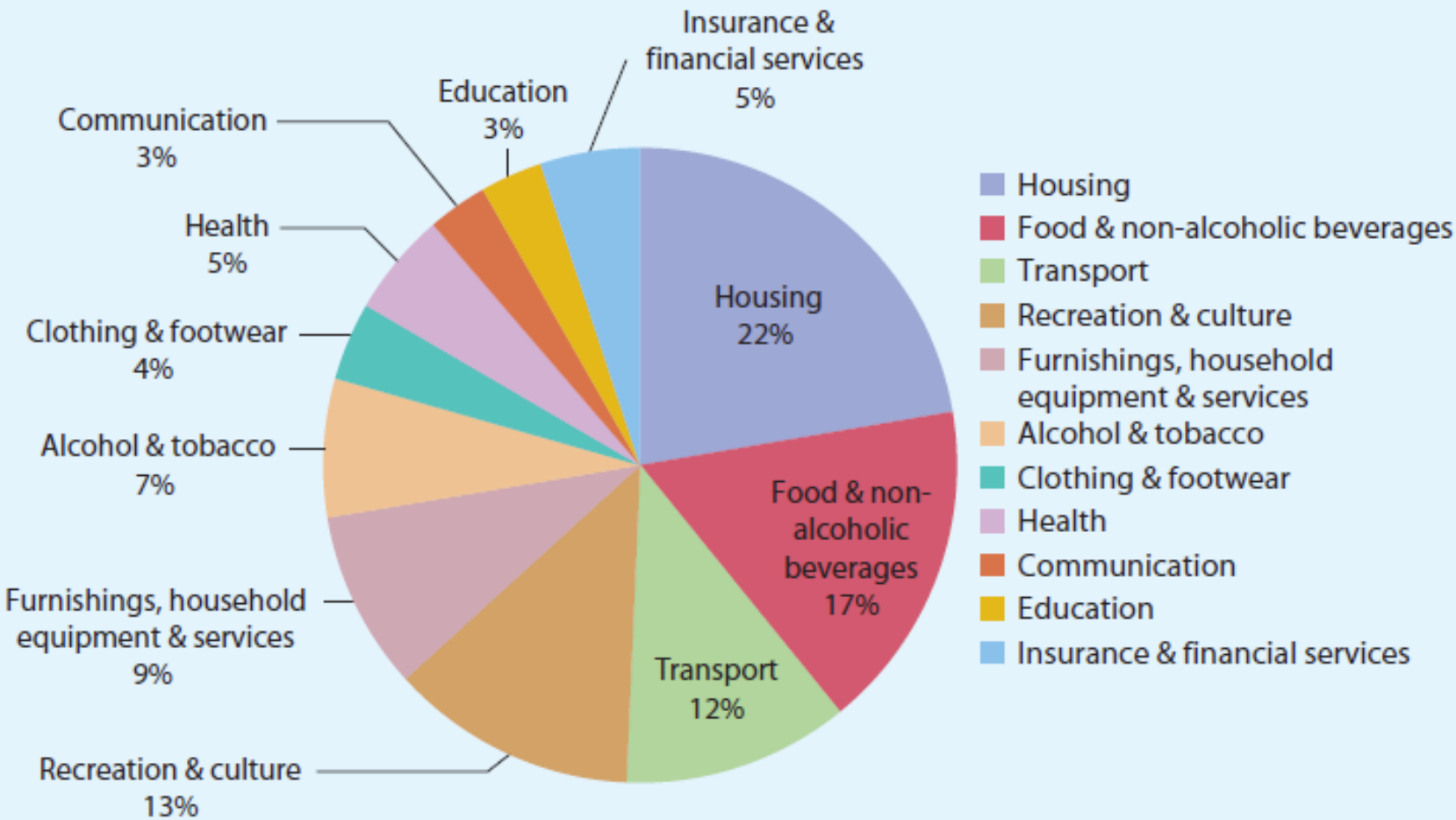
- The CPI is a measure of the overall cost of the goods and services bought by a typical consumer
- CPI is calculated by following a number of steps:
  1. Choose a 'basket' of goods
  2. Find the prices of those goods
  3. Calculate the cost of a 'basket'
  4. Choose a base year, and calculate the index
  5. Calculate the inflation rate.

CPI - Choose a Basket

- The 'basket' of goods is a list of the types of goods a typical consumer consumes each year, and how much they consume of each such good
- This data is gathered (in Australia) by surveying consumers and finding the basket of goods a typical consumer purchases
- The amount of each good purchased is used to determine the weight placed on the good in the calculation. If twice as many oranges are bought as apples, then oranges count twice as much in the calculation

CPI Basket for Australia

Figure 6.1 The basket of goods and services



Source: Australian Bureau of Statistics

CPI Calculation - Find a Basket

- We did a survey, and found the typical consumer last year purchased:
  - 5 bento boxes, and
  - 2 ice creams
- Now we have the basket, we need the prices

CPI Calculation - Find the Prices

We need the prices over a number of years:

Year	Price of Bento Box	Price of Ice Cream
2021	\$8	\$3.50
2022	\$9.50	\$4
2023	\$10.50	\$4.20

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CPI Calculation - Choose Base Year for CPI

- Now we need to choose a base year to be where the index is 100
- Base Year is usually chosen to be the earliest year
- Divide the cost of the basket this year by the cost in the base year, and multiply by 100

$$\text{CPI}(2023) = \frac{\text{Basket Cost}(2023)}{\text{Basket Cost}(2021)} \times 100$$

CPI Calculation - CPI Calculation

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2022	$(55.50/47) \times 100 = 118$

CPI Calculation - CPI Calculation

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2021	$(47/47) \times 100 = 100$
2022	$(55.50/47) \times 100 = 118$
2023	$(60.90/47) \times 100 = 130$

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- The inflation rate, using the previous information, is
  - Inflation Rate$(2022) = (118 - 100)/100 = 18\%$
  - Inflation Rate$(2023) = (130 - 118)/118 = 10\%$

More on the CPI

- CPI is reported for the nation, and separately for each capital city (Australia)
- A few different price indexes are also developed
  - Narrow categories of goods and services (food, clothing, health, etc.)
  - The Producer Price Index (PPI), where the basket is chosen based on producer purchases
- However, there are some issues with the CPI

Shortcomings of the CPI

- Substitution Bias
  - The basket of goods is only changed every four or five years
  - E.g. If bananas are cheap when the basket is chosen, then go up in price, consumers may substitute away from bananas.
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- New Goods
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- Improvements in Quality
  - Quality improvements increase standard of living
  - This can be accounted for to a degree, but is hard
  - Leads to CPI *overestimating* the change in the cost of living

CPI and GDP Deflator

- These will usually tell the same story, as they both measure changes in the purchasing power of money
- Exports are included in GDP deflator, but not in CPI. The reverse for imports
- CPI basket is fixed for some years, while the amount of goods used in GDP deflator changes

Correcting for Inflation

- Due to inflation, money today is not worth the same as money in the past
- Is $1000 today be worth more, or less, than $100 dollars in 1970?
- Use Inflation Calculators to find out, e.g. https://www.rba.gov.au/calculator/
- **Indexation** is a process where some nominal dollar amount is automatically adjusted for inflation.
- Many rental agreements in Australia are partially indexed for inflation

Why is GDP Different Between Countries?

- We saw on Monday that GDP per capita varies widely between countries
- Why is this? It's not population (since the data is per capita)
- So it must be differences in **productivity**
- Productivity measures the value of the goods and services an average worker produces with one hour of work

Determinants of Productivity

1. Human Capital
2. Physical Capital
3. Technology

Human Capital

- **Human Capital** is the knowledge and skills that a worker acquires through education, training and experience
- Higher levels of human capital allow workers to produce more value per hour of work, so increase productivity
- E.g. A skilled programmer, with strong theoretical knowledge from university and practical skills from experience, can produce a computer program much much faster than I can

Physical Capital

- **Physical Capital** is the stock of equipment, machines, and structures that are used to produce goods and services
- Generally, more physical capital lets workers be more productive
- E.g. A skilled programmer *could* write a computer program without the use of a computer, but is vastly more productive if they have access to a computer

Technology

- **Technology** is a measure of how well we can combine inputs together
- E.g. Use of Knowledge, or better organisation of resources
- E.g. Just-in-time retail logistics
- E.g. Zoom
- Better technology allows the economy to use it's labour and capital more efficiently
- In practice, 'technology' is the catch-all term for things which effect GDP, but which are not labour or capital

Another Input - Natural Resources

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- Too much natural resource can lead to the *Resource Curse*, or *Paradox of Plenty*

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- Output in this context should be thought of as GDP
- The important 'factors of production' are:
  - Labour (L) - Amount of work-hours per year
  - Average Human Capital (h)
  - Physical Capital (K)
  - Technology (A)

The Aggregate Production Function

- In principle GDP could be any function of these input factors. However...
- Labour and Human Capital can be combined into *total efficiency units of labour*, which is $H = L \times h$.
- Technology is also usually assumed to be multiplicatively separable from the rest. So Production is

$$Y = A \times F(K, H)$$

The Aggregate Production Function

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- Y is output (GDP)
- A is Technology
- H is efficiency units of labour
- K is physical capital
- F is the mathematical function linking the inputs and outputs

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  - Similarly for labour
- E.g. Cobb-Douglass Production Function: $Y = AK^{1/3}H^{2/3}$

Short-Run and Long-Run

- In the short-run aggregate production, one input is fixed (usually capital), and others are allowed to vary
- In a long-run aggregate production function, all inputs can vary

Economic Growth

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- Increasing Capital is fine, but (i) diminishing marginal product of capital, and (ii) capital depreciates over time
- Technology seems to be the answer. So how do we increase technology?